Retrofitting Tree-based Infiltration Trenches to Support Stormwater Reduction and Street Tree Transpiration

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Extensive impervious surfaces and constructed urban drainage networks designed to minimise flooding efficiently convey stormwater runoff to urban streams, resulting in degradation of receiving waterways. This can be mitigated through harvesting, detaining, and using stormwater runoff as a resource for passive irrigation of urban landscapes. Street trees can transpire water at very high rates, providing evapotranspirative cooling benefits to urban populations. However, they often suffer poor health due to soil moisture limitations which can compromise their transpiration and therefore, cooling benefits. Redirecting stormwater toward street trees may therefore reduce stormwater runoff and improve the canopy health and transpiration of street trees. To assess this, we installed infiltration trenches adjacent to mature street trees in residential nature strips. Two inlet designs that conveyed stormwater to infiltration systems were compared and we related transpiration to the volume of stormwater captured to determine the ecohydrological impacts of tree-based infiltration trenches. Overall, tree transpiration comprised a large part of the infiltration trench water balance and trees supplied with stormwater runoff showed higher transpiration. This suggests redirecting stormwater toward urban trees supports transpiration during challenging climate conditions which may improve cooling benefits. These results further highlight the ability for trees to transpire at high rates, which could improve stormwater capture by utilising retained stormwater at a faster rate than herbaceous species, allowing for greater retention in future stormwater events.